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| 09/866,843 | 05/30/2001 | Naoaki Ogure | 2001_0686A | 7255 |

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EXAMINER

GOUDREAU, GEORGE A

| ART UNIT | PAPER NUMBER |
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|----------|--------------|

1763

DATE MAILED: 04/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|--------------------------------|------------------------------|-------|
| Office Action Summary | Application No. 09/866,843 | Applicant(s) OGURE ET AL. | |
| | Examiner George A. Goudreau | Art Unit 1763 | _____ |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 January 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 21-53 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 21-23, 26, 27, 33-38, 40-43 and 45-53 is/are rejected.
- 7) ☒ Claim(s) 24, 25, 28-32, 39 and 44 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

George A. Goudreau
GEORGE GOUDREAU
PRIMARY EXAMINER

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Art Unit: 1763

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 21-22, 33, 35, and 45-48 are rejected under 35 U.S.C. 102(b) as being anticipated Horiike et. al. (5-1990')

Horiike et. al. disclose a multi-step process, and apparatus for conducting the anisotropic (i.e.-vertical etching) digital etching of a trench into a Si wafer. First, F atoms from a plasma, which is comprised of CF₄-O₂, are adsorbed onto the surface of a Si wafer, which is cooled to a temperature below which spontaneous etching with the F atoms would occur. Second, photoexcitation is used to promote or enhance the reaction of the adsorbed layer of F atoms with the surface of the Si wafer to form SiFx. Third, the SiFx is desorbed from the surface of the wafer by bombarding the surface of the wafer with an Ar⁺ ion beam. (The Ar ion beam is inherently a type of collimated beam.) The wafer is supported on a rotary chuck during processing in order to ensure the uniform treatment of the wafer during processing. This is discussed on pages 1844-1849. This is shown in figures 1-14.

3. Claims 21-22, 33, 35-37, 40, 45-46, and 48-50 are rejected under 35 U.S.C. 102(b) as being anticipated by Mizutani et. al. (1990').

Mizutani et. al. disclose a process for anisotropically etching a SiO₂ layer on a wafer by simultaneously supplying neutral CHF₃ radicals to the surface of a SiO₂ layer on a wafer while bombarding the adsorbed CHF₃ film on the SiO₂ layer with an Ar neutral beam. The Ar neutral beam, which has energy less than 500 eV, is formed by the charge exchange of an Ar⁺ beam. The CHF₃ radicals, which are adsorbed to the surface of the SiO₂ layer, are formed by extracting CHF₃ radicals from a CHF₃ based plasma. This is discussed in the abstract.

4. Claims 21-22, and 45-51 are rejected under 35 U.S.C. 102(b) as being anticipated by Hatakeyama (5,563,416).

Hatakeyama disclose a process, and apparatus for the anisotropic etching of a Si wafer (4), which rests on a rotary table (5). The wafer is etched by simultaneously supplying radicals (9) of a gas, which are extracted from a plasma while bombarding the surface of the wafer with a fast atomic beam (3). Different gas sources may be used to form the radical beam, and the fast atomic beam. This is discussed in columns 1-6. This is shown in figures 1-3.

In regards to applicant's recitation of a specific type of etch process in their apparatus claims, the examiner cites the case law listed below of interest to the applicant.

Furthermore, it is obvious to one skilled in the art that the configuration of the substrate worked upon by the apparatus claimed in this invention is not patentable in view of In re Young (25 U.S.P.Q. 69, 71 (CCPA 1935)) and In re Rishoi (94 U.S.P.Q. 71,73 (CCPA 1952)). The Court of Customs and Patent Appeals stated in In re Young that inclusion of material worked upon by a machine as element in claim may not lend patentability since claim is not otherwise allowable. Similarly, the Court of Customs and Patent Appeals stated in In re Rishoi that there is no patentable combination between a device and the material upon which it works.

Thus, it is irrelevant if the prior art specifically discloses applicant's claimed process as long as the prior art is capable of performing applicant's claimed process when evaluating applicant's apparatus claims against the prior art of record.

5. Claims 21-23, 26, 35-38, 45-46, and 48-49 are rejected under 35 U.S.C. 102(e) as being anticipated by Phaneuf et. al. (6,641,705).

Phaneuf et. al. disclose a process for depositing W onto a Cu layer inside a via hole on a wafer. The via hole is formed in a ILD layer which is lined with diffusion barrier. The W is deposited onto the surface of the Cu layer by simultaneously exposing the Cu to tungsten hexacarbonyl radicals while bombarding the surface of the Cu with a FIB comprised of Ga ions. This is discussed in columns 1-22. This is shown in figures 1-17.

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 34, and 42-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Horiike et. al. as applied in paragraph 2 above.

Horiike et. al. as applied in paragraph 2 above fail to disclose the following aspects of applicant's claimed invention:

- the specific usage of a laser to conduct the photoexcitation step used to form SiFx from the F atoms adsorbed to the Si surface; and
- the specific etch process parameters which are claimed by the applicant

It would have been obvious to one skilled in the art to employ a laser in the photoexcitation step used to enhance the reaction of the Si with the F absorbed to the Si surface in the process taught above based upon the following. It is conventional or at least well known to employ a laser (i.e.-a type of UV light source) in the conduction of a photo CVD process. (The examiner takes official notice in this regard.) Further, Horiike et. al. specifically teach that it is desirable to use a laser to conduct a type of photo CVD

process (i.e.-the deposition of Si onto a Si surface from an Si₂H₆ gas layer absorbed to the surface of the Si wafer).

It would have been prima facie obvious to employ any of a variety of different etch process parameters in the etching process taught above including those which are specifically claimed by the applicant. These are all well known variables in the etching art, which are known to affect both the rate and the quality of the etching process. Further, the selection of particular values for these variables would not necessitate any undo experimentation, which would have been indicative of unexpected results.

Alternatively, it would have been obvious to one skilled in the art to employ the specific process parameters, which are claimed by the applicant based upon *In re Aller* as cited below.

"Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F. 2d 454, 105 USPQ 233, 235 (CCPA).

Further, all of the specific process parameters, which are claimed by the applicant, are result effective variables whose value is known to affect both the rate, and the quality of the etching process.

9. Claims 34, 41, 47, and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mizutani et. al. as applied in paragraph 3 above.

Mizutani et. al. as applied in paragraph 3 above fail to disclose the following aspects of applicant's claimed invention:

- the specific etch process parameters which are claimed by the applicant; and
- the specific usage of a turntable to support the wafer during process

It would have been obvious to one skilled in the art to use a turn table to support the wafer during the etching process taught above based upon the following. It is conventional or at least well known in the dry etching arts to use a turntable to support a wafer during the etching process. (The examiner takes official notice in this regard.) Further, this would have simply provided a means for desirably improving the uniformity of the etching process by providing a means for rotating the wafer during the etching process.

It would have been prima facie obvious to employ any of a variety of different etch process parameters in the etching process taught above including those which are specifically claimed by the applicant. These are all well known variables in the etching art, which are known to affect both the rate and the quality of the etching process. Further, the selection of particular values for these variables would not necessitate any undo experimentation, which would have been indicative of unexpected results.

Alternatively, it would have been obvious to one skilled in the art to employ the specific process parameters, which are claimed by the applicant based upon In re Aller as cited below.

"Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F. 2d 454, 105 USPQ 233, 235 (CCPA).

Further, all of the specific process parameters, which are claimed by the applicant, are result effective variables whose value is known to affect both the rate, and the quality of the etching process.

10. Claims 52-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hatakeyama et. al. (5,883,470).

Hatakeyama et. al. disclose a process, and apparatus for etching a wafer using a FAB to treat the surface of the substrate in the presence of a HCl ambient gas. The FAB is comprised of a cylindrical tube (21) in which a plasma is generated using an RF inductively coupled coil (25), which surrounds the plasma generation tube. DC biased, porous electrodes (29, 30) are used to cap each end of the tube. A FAB is formed when positive ions in the gas are accelerated toward the negative electrode (30). The positive electrode (29) is optimally spaced 15 mm from the negative electrode (30). The electrode plates (29, 30) have a diameter of 15 mm (i.e.- the internal diameter of the tube). Thus, there is a 1.0/1.0 ratio between these two quantities. This is discussed specifically in column 4-6; and discussed in general in columns 1-10. This is shown in figures 1-4. Hatakeyama et. al. fail to specifically disclose the following aspects of applicant's claimed invention:

- the specific usage of anode, and cathode electrodes in the FAB apparatus which have the specific diameter which is claimed by the applicant; and

-the specific spacing of anode, and cathode plates in the FAB beam apparatus,
which is claimed by the applicant

It would have been prima facie obvious to employ any of a variety of FAB electrode diameters, and FAB electrode spacing in the apparatus which is taught above including those which are specifically claimed by the applicant. These are all well known variables in the FAB processing art, which are known to effect both the rate and quality of the FAB process. Further, the selection of particular values for these variables would not necessitate any undue experimentation, which would be indicative of a showing of unexpected results.

Alternatively, it would have been obvious to one skilled in the art to employ the specific FAB electrode spacing, and the specific FAB electrode diameter, which is claimed by the applicant, based upon In re Aller as cited below.

"Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F. 2d 454, 105 USPQ 233, 235 (CCPA).

Further, these are all results effective variables whose values are known to effect both the rate, and the quality of the FAB process. Also, Hatakeyama et. al. teach that the electrodes in their FAB apparatus may be 15 mm in diameter which is close to applicant's claimed limit of 14 mm. Further, they teach that their FAB electrodes may be spaced between (5-100) mm apart from each other with an optimal spacing of 15 mm.

11. Claims 27, 47, and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Phaneuf et. al. as applied in paragraph 5 above.

Phaneuf et. al. as applied in paragraph 5 above fail to disclose the following aspects of applicant's claimed invention:

-the specific usage of a turntable to support the wafer during the deposition process

It would have been obvious to one skilled in the art to use a turn table to support the wafer during the deposition process taught above based upon the following. It is conventional or at least well known in the deposition arts to use a turntable to support a wafer during the deposition process. (The examiner takes official notice in this regard.) Further, this would have simply provided a means for desirably improving the uniformity of the deposition process by providing a means for rotating the wafer during the deposition process.

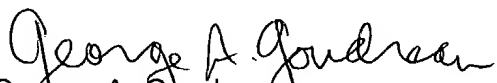
12. Claims 24-25, 28-32, 39, and 44 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

13. Applicant's arguments with respect to claims of record have been considered but are moot in view of the new ground(s) of rejection.

Art Unit: 1763

14. Any inquiry concerning this communication should be directed to examiner

George A. Goudreau at telephone number 571-272-1434.


George A. Goudreau
Primary Examiner
Art Unit 1763